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ABSTRACT

According to the Third International Mathematics and Science Study (TIMSS) which compared student performance in mathematics and science in 41 countries in 1995, fourth grade students in the United States perform only slightly above the international average in mathematics. The study showed that most U.S. students are mastering basic arithmetic; however, TIMMS found that U.S. eighth grade students perform below the international average in mathematics. The U.S. was the only country in TIMMS whose students dropped from above average in fourth grade to below average in eighth grade. It is suggested that between grades four and eight, U.S. students need to progress to more advanced mathematics like the students in top-performing countries. This pamphlet includes examples of two challenging mathematics problems that U.S. students did poorly on. In the global economy of the Information Age, students will need to master the basic and advanced mathematics. Students taking algebra, geometry, and other advanced courses in high school are more likely to go to college regardless of their families' income level. Other findings indicate that one out of three job applicants lacks the reading or math skills required for a job and that approximately 90% of new jobs created require more than a high school level of literacy and math skills. Information on the complete TIMSS Resource Kit is also included. (AIM)

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Mastering Challenging Mathematics

BY THE END OF EIGHTH GRADE

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Office of Educational Research and Improvement
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OUR STUDENTS ARE LEARNING THE BASICS OF ARITHMETIC

According to the most thorough international comparison of international education ever conducted, U.S. fourth graders perform slightly above the international average in mathematics. The Third International Mathematics and Science Study, or TIMSS, compared the students of 41 countries in 1995, including our major trading partners. It showed that most U.S. students are mastering basic arithmetic.

And, we are doing better over time. According to the National Assessment of Educational Progress (NAEP), the percentage of eighth graders who "can add, subtract, multiply, and divide using whole numbers, and solve one-step problems" rose from 65% in 1978 to 79% in 1996.

OUR STUDENTS DO LESS WELL IN MASTERING MORE ADVANCED MATHEMATICS

TIMSS found that U.S. eighth graders perform below the international average in mathematics. The U.S. was the only country in TIMSS whose students dropped from above average in fourth grade to below average in eighth grade.

Why is this the case?

U.S. students typically study arithmetic through seventh or eighth grade. Beginning in fourth grade, students in top-performing countries practice arithmetic but are also introduced to algebra, geometry, probability, and other topics. Between grades four and eight, U.S. students need to progress to more advanced mathematics, including algebra and geometry.

WHAT DO WE MEAN BY CHALLENGING MATHEMATICS BY THE END OF EIGHTH GRADE?

From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

(A) 10 (B) 20 (C) 30 (D) 40 (E) 50

Only 36% of U.S. students answered this correctly. (Answer on back panel)

Source: National Assessment of Educational Progress

Peter bought 70 items, and Sue bought 90 items. Each item costs the same, and the items cost $800 altogether. How much did Sue pay?

Only 23% of U.S. eighth graders answered this correctly, compared to the following percentages of students in other selected countries: Singapore, 83%; Japan, 71%; Korea, 62%; and Germany, 57%. (Answer on back panel)

Source: Third International Math and Science Study

These questions require students to think through multiple steps to solve the problem. Although students are required to use basic arithmetic, they must go further, understanding when to apply each operation. The skills tested are among those students will need in the real world in their daily and professional lives — determining costs or making predictions based on available data. From analyzing the stock market to estimating supplies needed for a home improvement project, these are essential skills.

PREPARING STUDENTS FOR A LIFETIME OF SUCCESS

In the global economy of the Information Age, students will need to master the basics and advanced mathematics.

- Students who take algebra, geometry and more rigorous mathematics courses during high school are more likely to go to college. This is true regardless of their families' level of income. Low-income students who take algebra and geometry are almost three times as likely to attend college as those who do not.
- A recent study by the American Management Association found that one out of three job applicants tested by U.S. companies lacked the reading or mathematics skills required for the job.
- Almost 90% of the new jobs being created require more than a high school level of literacy and math skills.
- An entry level automobile worker, according to an industry-wide standard, needs to be able to apply formulas from algebra and physics to properly wire the electrical circuits of a car.

SUPPORTING OUR TEACHERS

Teachers need opportunities for ongoing professional development. The U.S. Department of Education and the National Science Foundation have prepared a Comprehensive Action Strategy for using federal resources to assist states and local school systems to meet challenging mathematics standards, and professional development is a key focus.

SOME TOOLS FOR IMPROVING STUDENT ACHIEVEMENT

Voluntary National Test in Eighth-Grade Mathematics — A Critical Checkpoint

President Clinton has proposed the voluntary national tests in reading at fourth grade and math at eighth grade to help parents and teachers compare each student's performance against national and even international standards. The math test will be based on the same framework as the existing National Assessment of Educational Progress (NAEP), in which over 40 states participate. Because teachers, parents, and schools will receive detailed information about students' performance on individual items, the tests will stimulate improvement in reading and mathematics instruction and provide parents with information to help their children.

TIMSS Resource Kit

The Education Department has developed a ***TIMSS Resource Kit*** that translates the research findings from TIMSS into a format that can be used to shape discussion on improving mathematics instruction with educators and the community at large. The kit comprises four modules that cover the results of the international comparison, an examination of curriculum, and a study of teaching in three countries. An overview videotape, as well as a videotape study of teaching in the United States, Japan, and Germany, are included.

For more information about the Voluntary National Tests in Reading and Math, visit our web site at http://www.ed.gov/nationaltests, or call 1-800-USA-LEARN.

To order the TIMSS Resource Kit, contact the TIMSS customer service line at (202) 219-1333. Or write TIMSS Project Officer, National Center for Education Statistics, U.S. Department of Education, 555 New Jersey Ave., N.W., Washington, D.C., 20208-5574. For more information on TIMSS, consult the World Wide Web site at http://www.ed.gov/NCES/timss.

For more information on the Mathematics Initiative of the U.S. Department of Education, call (202) 401-3389.

Brochure available in alternate formats on request. Call FIRS, 1-800-877-8339, Monday through Friday from 8 a.m. to 8 p.m., Eastern Time.

(Answers to math questions: (D) 40, $450)

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